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ABSTRACT

This study of state agency use of facsimile transmission--a generic term used to refer to any of several communication techniques for sending half-tone hard copy pictures by wire or radio circuits--includes a discussion of the advantages and disadvantages of the medium. Users are divided into two groups: those that utilize facsimile as an integral part of their communications network (e.g., Department of Welfare, Department of Corrections, State Water Control Board, Tidewater Library Consortium), and the occasional user of facsimile for special needs (e.g., universities, Department of Education, Virginia Public Telecommunications Council). State facsimile policies and expenditures are reviewed, and several problem areas where a central state planning agency could play a significant role are identified: (1) the determination of user needs, (2) consolidation and areas for systems expansion, (3) telephone utilization (budgetary considerations), and (4) research and development, including the identification of new systems and innovative applications. Performance specifications of telecopiers in use by state agencies and institutions are provided in Appendix A, and selected state users of telecopiers and their expenditures for 1978 are listed in Appendix B. (RAO)

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Working Paper #18

TELECOMMUNICATIONS STUDY COMMISSION

THE USE OF FACSIMILE TRANSMISSION IN VIRGINIA

SEPTEMBER 6, 1979

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The Use of Facsimile--An Overview

Facsimile (exact copy) is a generic term used to refer to any of several communication techniques (e.g., rotating spiral, and oscillating mirror) for sending half tone hard copy pictures by wire or radio circuits.[1] Facsimile systems perform the same functions as an ordinary office copier except that a considerable distance is involved and two pieces of hardware are needed. The transmitting facsimile scans the message to be sent and converts half tones into electric signals which are received at another location where half tones are converted back and recorded. Most facsimile systems use common voice-grade telephone lines for transmission.[2] Telephone provides great flexibility, however, because of limited band width, the resolution obtained is inferior to other forms of transmission.

As is true for copiers in general, Xerox Corporation dominates the hardware market for telecopiers (facsimile over telephone). The most important hardware performance specifications relate to speed, resolution and document size. Generally, as transmission

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[1] Half tone processing involves the scanning of a page and transmitting each light and dark element.

[2] Use of telephone transmission requires a modem for converting digital facsimile signals to analog telephone signals (modulation) and then converting these signals back to digital signals at the receiving facsimile (demodulation).

speed increases, resolution or quality decreases (Appendix A). Another important consideration for facsimile is machine compatibility. Hardware having compatibility, or adjustment capabilities, is particularly important in regards to transmission speed since different types of equipment transmit and receive at different rates.

The use of facisimile units, nationally, has increased rapidly in recent years from 22,000 units in 1970 to 135,000 units in 1978. Facsimile transmission has some definite advantages vis-a-vis other forms of telecommunications, for business, industry and government which include:

1. It is faster than first class mail or messenger.
2. Facsimile transmission is less susceptible to errors than teletypewriters or telephone communications.
3. Facsimile is extremely efficient for sending official and authentic documents (particularly if signatures are needed), tabular materials, charts, graphs, and time critical documents.

There are, however, a number of disadvantages to facsimile which limit its potential and make its effectiveness strictly dependent on individual user cost/benefit assessments, these include:

1. Telephone, teletypewriter, priority mail, and intelligent terminals can perform many of the same functions at less costs. Morever, telephone and teletypewriter are just as fast.
2. Compared to telephone, teletypewriter facsimile transmission is very slow (e.g., Xerox 400 - 4 minutes for one page 8 1/2" x 11"). This results in increased personnel time and costs.
3. Except for graphic materials, the quality of facsimile is often poor, particularly over voice grade telephone circuits (Wells, 1978).
4. The use of facsimile, except for graphics, handwritten material, and special characters may be curtailed by the expanded use of intelligent terminals (copying devices

having microprocessing and memory units). These copiers will be more efficient and less costly than facsimile. For example, intelligent copiers transmit bits describing characters, rather than halftones; this increases speed, improves resolution, and reduces data transmission requirements. Moreover, the so-called "office of the future" may have little need for traditional facsimile. The efficiencies of word processing operations now emerging will have to be matched with equally efficient telecommunication. This means interfacing office equipment with intelligent terminals. Examples of this interface are the emerging electornic mail systems (i.e., intelligent terminals interfaced with computer) (Baer, 1978).

Efficient use of facsimile is particularly dependent upon individual user needs within a network. Thus, within a network different user requirements are found; these include:

1. Some users will have a need to transmit heavy volumes but receive little.
2. Some users will receive a lot of material and transmit little.
3. There may be a need to send or receive from all points simultaneouslv.

Use of Facsimile in Virginia

The Office of Governmental Telecommunications Services (OGTS), which is one of VPTC's two functional units, has responsibility for planning, managing and coordinating of facsimile equipment and services for state agencies and institutions. Basically, the Commonwealth's use of facsimile can be divided into two classifications. First, users that utilize facsimile as an integral part of their communications network (e.g., Department of Welfare, Department of Corrections (which has the most extensive facsimile network), State Water Control Board, and the Tidewater Library Consortium). These users transmit heavy volumes of facsimile. The second group is comprised of occasional users who use facsimile for special needs (e.g., universities, Department of Education, and VPTC).

Communication is greatest for state agencies and institutions having the need to send and/or receive official documents between and among state and federal offices (Appendix B).

State Facsimile Expenditures and Policies

As previously stated, Xerox Corporation dominates the market for telecopiers. It is estimated that 95% of all state facsimile equipment is provided by Xerox. Virginia has approximately $250,000 worth of equipment in place (Appendix B) which includes an estimated 150 Model 400s, 25 Model 410s, and 2 Model 200s. About 80% of all facsimile equipment is acquired on lease purchase arrangement through the Division of Purchases and Supply (DPS) with Xerox. Xerox Corporation negotiates an annual facsimile contract with the Federal General Services Administration and then offers the same agreement to the Virginia DPS. State agencies and institutions make requests for facsimile equipment to DPS which then secures the most favorable vendor bid. It costs the State approximately $50,000 (not including telephone costs) for facsimile transmission. (It should be noted that all cost figures are estimations since the State does not figure collective facsimile costs.)

Xerox is usually selected for several reasons including maintenance (Xerox has statewide service center), equipment compatibility (since most state equipment in place is Xerox), and competitive price lists. Some state agencies and institutions rent facsimile equipment (15% of total use). Rental arrangements are made directly with Xerox. The average monthly rental charge is $50.00.

Users transmit facsimile over voice grade telephone lines. Agencies and institutions are not billed separately for facsimile transmissions, rather the billing rate is the same as voice SCATS and is included in the bill as voice communications.

Need for Improvements

The Office of Governmental Telecommunications has complete authority for state planning, management and coordination of facsimile equipment and services. However, OGTS does not have the staff assigned or the necessary expertise to carry out these mandates. The resulting planning, management and coordination void is partially filled through DPS (as previously described), vendor (both for service and hardware) and with user agency personnel who may or may not have expertise. Individual agencies rely on vendor support and/or inter-agency or intra-agency personnel on an ad hoc basis. Research into the results of these activities suggests a haphazzard piecemeal approach that allows little systematic planning, management, or coordination and probably results in unnecessary expenditures, increased costs, and inefficient service.

This research has identified several problem areas concerning facsimile transmission where a central state planning, management and coordination agency could play a significant role:

1. Determination of User Needs:

   Comprehensive needs assessment or evaluation of facsimile use in Virginia has never been done; therefore, it is not possible to determine if current facsimile operations are cost effective or even if present or new operations are needed. An evaluation and needs assessment for facsimile is particularly important for the following reasons:

   a. Multiple types of equipment are available at considerable cost differences (Appendix A). If agencies rely on vendors or agency personnel without expertise, there is no basis on which to be sure you have the most efficient cost/benefit system.

   b. Facsimile is a "status" item; thus, the possibilities of purchasing unneeded equipment are increased.

   c. There is not presently, or has there been in the past,

a "contact person" at OGTS with expertise in facsimile to assist DPS and user agencies. The determination of whether to purchase facsimile, what type of equipment and which vendor can only be made after an assessment of agency needs. Table 1 shows a comparison of facsimile performance specification needed by each class of state users. These needs must be taken into consideration prior to purchase. However, many state agencies (e.g., Medical College of Virginia Library , Department of Motor Vehicles, State Corporation Commission, and Marine Resources Commission) who were occasional users have discontinued use of facsimile equipment. These agencies realized, only after expensive equipment purchase or rental, that facsimile is not useful for many different reasons (e.g., too slow, poor quality, too expensive, and seldom needed).

TABLE 1

A Comparison of Class 1 and Class II State Facsimile Users Sensitivities to Performance Specifications

	Class 1 - Heavy Users	Class II - Occasional Users
	Sensitivities	Sensitivities
Variables		
1. Cost of transmission per copy	Yes	No
2. Cost of equipment	No	Yes
3. Resolution	Yes	No
4. Speed	Yes	No
5. Machine options	Yes	No

SOURCE: Author

2. Consolidation and Areas for Systems Expansion

Generally, use of facsimile equipment by state agencies and institutions has increased rapidly. Since hundreds of units are in use, the total state expenditure is considerable.

It appears that the most efficient and economical use of facsimile equipment is not being made. As previously stated, many users (occasional users) have discontinued use because of dissatisfaction with results; however, this does not preclude these agencies and institutions having need for emergency transmissions (e.g., official reports to the central office). Moreover, a number of agencies and institutions, who have occasional facsimile needs, do not avail themselves of this service because of high equipment cost. The purchase of centrally located and shared facsimile equipment may provide a solution. For example, a high volume facsimile machine (e.g., Xerox 200) could be placed in the mail rooms of large state office buildings or at one central location (e.g., state mail and message office - DPS). Thus, service to a great number of occasional users could be provided. This type of system would be particularly efficient between large urban nodes (i.e., Richmond, Tidewater, Northern Virginia/Washington). To achieve maximum use of this system, all state agencies and institutions should be assigned a telephone number for facsimile and be listed in the state government telephone directory.

Facsimile networks (heavy users) are being used by only a few agencies. There is a need for a central state planning agency to investigate possible expansion of present networks and research the possibilities for other agencies and institutions to develop networks. This should be accomplished with the full knowledge that changing technologies may limit the utility of traditional facsimile in the future.

3. Telephone Utilization

Charges for facsimile transmissions are billed by OGTS at voice SCATS rates. However, heavy facsimile users are sensitive to cost per copy (see Table 1). This fact combined with the average time required for transmission (4 minutes) results in considerable costs which effect systems expansion and development. Presently, however, true transmission costs are not available, although OGTS could easily derive them. Transmission costs are indispensable for the planning and development of new and existing systems.

Better utilization of SCATS billings rates could be obtained from facsimile transmissions. SCATS arrangements are in

effect 24 hours per day, however, most state use occurs between 8 a.m. and 5 p.m. on weekdays. Facsimile transmission could be scheduled for off hours and weekends to effectuate better utilization of SCATS both from increased use and by relieving congestion during peak voice times.

4. Research and Development

Presently, the OGTS does not have staff qualified to promote use of modern facsimile equipment. The need to keep abreast of changing technologies is particularly important for telecopiers because of the plethora of new equipment being developed. Examples of systems improvements include high speed modems, high speed printers, CRT scanners, and laser facsimile. Examples of system replacements and innovative technologies include intelligent terminals, intelligent telephones, and television and radio transmission. Television and radio transmission will probably be most effective for facsimile using "ancillary" signals as described below:

> "Within recent years, it has become quite apparent that the television (and radio) signal is capable of so-called "ancillary" signals which can be piggybacked onto the program signal without causing any adverse effects (This process is generically referred to as teletext). The vertical blanking interval (used for test patterns, etc) has proved to be the most promising location for such ancillary signals . . . for both message and graphic transmission." (O'Connor, 1979)

Research and development should include the identification of new systems and innovative applications. For example, New York State's Division of Criminal Justice and Safety had problems with the quality of fingerprints being sent via traditional telefacsimile method to Albany (i.e., greater resolution was needed). State electronic communication specialists solved the problem after considerable product research and discussion on possible stretegies. The final solution involved the utilization of laser facsimile equipment (250 lines in) interfaced with microwave and cable television transmission since voice grade telephone doesn't have sufficient band width for laser facsimile.

In Virginia there appears to be a need for the transmitting of "hard copy" emergency orders and instructions from the Office of Energy and Emergency (OEE) to local and state government agencies statewide. A facsimile network could be established to accomplish this and it may be possible to utilize the State Police microwave system as the transmission medium (sharing of microwave should also be investigated for other user facsimile applications). Another possible OEE application involves gasoline allocations. Presently, 3% of all fuel coming to Virginia is reserved in escrow by OEE for emergency allocations. Oil companies require "hard copy official authorization" before the release of contingency supplies. This notification currently takes at least two days through U.S. mail. A facsimile system (already in place for oil companies) may expedite this release.

Conclusions

This research leads to the following conclusions:

1. The existing facsimile systems in Virginia are individual and autonomous in nature. There is no general coordination on a statewide all technologies level;

2. There are rapidly increasing needs for new and additional services where new technology can play a significant role;

3. Maximum efficiencies and economies in the use of existing facsimile equipment and services are not being realized;

4. Effective long-range planning is virtually absent;

5. There is no active central statewide planning and management of facsimile systems performing such functions as determinations concerning costs, user needs, effective telephone utilization, and systems consolidation and expansion;

6. There is no active statewide central research and development work performing such functions as improving existing applications, investigating the feasibility of new systems, and the promotion and demonstration of new technologies.

APPENDIX A

Performance Specifications for Telecopiers in Use by State Agencies and Institutions

Xerox Telecopier 200

The Telecopier 200 is a facsimile transmitter-receiver or "Transceiver" which can reproduce virtually all documents by sending them through ordinary phone lines. The transceiver continuously monitors the telephone lines for incoming calls, answers, receives the messages, and disconnects the call. It feeds documents automatically, prints incoming messages from a self-feeding paper supply and can send and receive without operator intervention. The Telecopier 200, the most versatile facsimile terminal available, can transmit an 11" document in 2 minutes, allowing use for high volume applications. It is completely compatible with other Xerox facsimile equipment and automatically adjusts to the Telecopier 400-1 and Telecopier 410 speeds. Received copies are highly legible, crisp, black-on-white xerographic copies on bond paper.

Specifications

Dimensions:

Length: 31"
Width: 17"
Height: 37"
Weight: 175 lbs.

Electrical Requirements: 120 VAC, 60 H_z, 500 VA, single phase, 2 wire plus ground

Operating Environment:

Temperature: 60 degrees to 90 degrees F
Relative Humidity: 5% to 85%

Speed/Resolution:

8 1/2" x 11: Document	Resolution (Vertical/horizontal)	Speed: inches/min.
2 min.	77/80 Lines/In.	5.62
3 min.	96/96 Lines/In.	3.74
4 min.	64/96 Lines/In.	2.81
6 min.	96/96 Lines/In.	1.87

Input/Output: Input: Automatic Document Feeder accepts documents 7" to 9" wide and from 5" to 14" long. It is capable of automatically feeding different weight documents on paper from 12 lb. to 36 lb. Documents from 7" to 9" wide by any length can be fed manually.
Output: On ordinary, unsensitized 20 lb. bond paper from 8 1/2" by 350 ft. roll

Xerox 400 Telecopier

The Xerox 400 Telecopier is a facsimile transmitter-receiver or "Transceiver" which can reproduce virtually all letter size documents by sending or receiving them through ordinary phone lines. It operates acoustically at a speed of four or six minutes per page simply by placing the phone handset in the Telecopier. The device is portable. A carrying case is available for purchase.

Xerox 400-1 Telecopier

The Xerox 400-1 Telecopier has all of the features of the 400 Telecopier and it has certain electronics for use with future products.

Specifications

Weight: 18 lbs.

Dimensions: Height: 4 5/8"
Width: 18 3/8"
Depth: 13 3/8"

Electrical Requirements: 120 volts, 60 cycles single phase, grounded

Input Material: Maximum 8 1/2" x 11" - no minimum
Width: up to 8 1/2"
Length: up to 11"
Thickness: .002" to .007"

(A carrier is available for use with documents thinner than .002" or damaged documents.)

Output Material: Standard Size 8 1/2" x 11" Recording Paper

Image Size: Width 8.3"
Length: Entire document except top and bottom 1/4"
Resolution: 64 lines per inch vertical by 96 lines per inch horizontal at 4-minute speed
96 lines per inch horizontal and vertical at 6-minute speed

Xerox 410 Telecopier

The Telecopier 410 is a facsimile transmitter-receiver or "Transceiver" which can reproduce documents by transmitting them through ordinary phone lines. The Transceiver comes equipped with a built-in acoustic coupler for the telephone handset. The Xerox 410 can be operated by simply plugging into a standard electrical outlet, making a phone call to another Telecopier, and then placing the handset in the coupler. Because it's compact and quiet, the 410 will operate anywhere.

When coupled with the UNA (Unattended Answering) Device, the 410 gives you completely automated message sending and receiving capabilities for up to 75 documents. It can offer this convenience because of its automatic document feeder and its electronic "handshaking" capability.

Specifications for Telecopier 410

Weight: 65 lbs.

Dimensions:
Height: 9"
Width: 22 1/2"
Depth: 30"

Electrical Requirements: 120 volts, 60 cycles, single phase, grounded

Input Material: Maximum 8 1/2" x 11" - no minimum
*Width: 8" to 8 1/2"
*Length: 5" to 11"
*Thickness: .003 to .007"

*A document carrier may be used for documents smaller than 5" in length, 8" in width, thinner than .003" or damaged documents.

Output Material: Standard Size 8 1/2" x 11" Recording Paper

Image Size:
Width: 8.3"
Length: Entire document except top and bottom 1/4"
Resolution: 64 lines per inch vertical by 96 lines per inch horizontal at 4-minute speed
96 lines per inch horizontal and vertical at 6-minute speed

Source: Xerox Corporation vendor catalogue

APPENDIX B

Selected State Users of Telecopiers
and Expenditures for 1978

Agency	1978 Costs
Department of Corrections	$ 21,512.00
State Water Control Board	12,255.00
Department of Welfare	6,273.00
State Office of Energy and Emergency Services	2,914.00
Norfolk State College	2,743.00
Marine Resources Commission	2,058.00

Source: Division of Purchases and Supply

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